

Growth and survival of a geometrid defoliator *Hyposidra infixaria* Walker (Lepidoptera: Geometridae) on four clonal varieties of tea

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Abstract: The growth and survival of a geometrid defoliator, *Hyposidra infixaria* Walker were studied on four popular clonal varieties (TV1, TV9, TV25 and Teen ali 17) of tea *Camellia sinensis* in the laboratory with an aim to find out the most suitable clonal variety of tea for the insect. The results showed that the larval period of *H. infixaria* on TV25 clone was significantly shorter (15.78 d) than that on TV1 (18.14 d), TV9 (18.00 d) and Teen ali 17 (17.00 d) clones. There were two variations in the larval instar numbers, those being the five- or six-instar type. The incidence of the six-instar type fed on TV25 was higher than those fed on other three clones. Larval and pupal weights were also significantly higher on TV25 than other three clones. Similarly, the survival of immature stages of *H. infixaria* fed on TV25 was significantly higher than other three clones. Based on growth parameters and survival, TV25 was found to be the most preferable clonal variety of tea for *H. infixaria*.

Key words: *Hyposidra infixaria*; tea looper; growth; survival; tea (*Camellia sinensis*)

1 INTRODUCTION

The geometrid defoliator, *Hyposidra infixaria* Walker, is a polyphagous herbivore that has assumed a major pest status in tea plantations of Dooars situated at sub-Himalayan West Bengal in recent years (Basu Majumder and Talukdar, 2009). Holloway (1993) reported this insect to be a lowland forest species distributed from N. E. Himalaya to Taiwan of China. According to Robinson *et al.* (2000), larvae of *H. infixaria* are common on *Buchanania* spp., *Cinnamomum* spp., *Coffea* spp., *Psidium guajava*, *Punica granatum* etc. but not on *Camellia* spp.

It is well known that growth, development and survival of insects depend on the quality and quantity of food they consume (Scriber and Slansky, 1981). The inter varietal effects of a host plant on different life-history traits of insects, including larval and post larval development have been proved for some insects (Barrigossi *et al.*, 2002; Pansaree *et al.*, 2006). However, no such studies were conducted for *H. infixaria* which has been observed feeding on a wide range of planting materials (including clonal varieties, seed plants and jats) of tea and damaging them potentially. Therefore, in the present study, the growth and survival of *H. infixaria* on some popular clonal varieties of tea were assessed in order

to find out their suitability to the insect.

2 MATERIALS AND METHODS

The study was carried out during summer of 2008 in the laboratory of Plant Protection unit at North Bengal Regional R&D Centre, Nagrakata (erstwhile Nagrakata Sub-station), Tea Research Association, West Bengal, India at temperature range of 24°C – 32°C and 65% – 85% RH. The experiment was started with the collected eggs from the laboratory culture of the insect. Four clonal varieties of tea *Camellia sinensis* (L.) Kuntz, *i. e.*, TV1, TV9, TV25 and Teen ali 17, raised and maintained at the experimental plot of NBRDC, Nagrakata, were used under the present study. These clonal varieties were released by Tocklai Experimental Station, Assam, India, and are widely planted in the tea plantations of Northeast India. For each clone, 20 newly hatched 1st instar loopers of *H. infixaria* were individually transferred to the pesticide free tender shoots (containing three leaves and a bud) with the help of fine brush. The cut end of the shoots were put into small vials (2.5 cm) containing water and plugged with cotton. The shoots with loopers were kept into glass chimneys (20 cm) and the mouths of the chimneys were covered with fine malma cloth held with rubber band for

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Received: 2011-02-15; Accepted: 2011-05-13

ventilation. Fresh shoots were supplied to the loopers as and when required till feeding stage was over. Loopers were checked daily for moulting and mortality. The duration of larval instars was determined by moulted head capsules of the larvae. Similarly, records on the prepupal period (stoppage of feeding to larval-pupal moult), pupal period (pupa to adult eclosion) and adult longevity were taken. Other measurements like lengths of full grown loopers, prepupa and pupa and wing expanse of moths were recorded with standard ruler having 0.25 mm precision whereas weight of the larva, pre-pupa and pupa was recorded by a digital balance (METTLER PM 2000).

The data were analyzed following ANOVA technique, and means were separated with the DMRT (Duncan's Multiple Range Test) using statistical software SPSS 10.0.

3 RESULTS

3.1 Developmental duration

Significant variation in the duration of total larval period of *Hyposidra infixaria* was recorded when reared on four different clonal varieties of tea namely, TV1, TV9, TV25 and Teen ali 17 (Table 1). The total larval period was shortest on TV25 (15.78 d) and longest on TV1 (18.14 d) being at par with TV9 (18.00 d). The durations of all the six instars of *H. infixaria* except 2nd instar were

significantly influenced due to feeding on different clonal varieties of tea. The duration of 2nd instar ranged from 2.11 to 2.43 d on different clones. Amongst different instars, the 6th one was the longest while 2nd instar was the shortest. Duration of 6th instar was longest on TV1 (5.67 d) and shortest (4.50 d) on Teen ali 17 and TV25.

Unlike larval duration, prepupal, pupal duration and adult longevity of the insect did not vary due to feeding on different clones. In general, prepupal and pupal period ranged from 2–3 d and 7–9 d, respectively. Similarly, adult longevity ranged from 4–6 d on all the clones (Table 2).

3.2 Growth parameters

Results furnished in Table 3 revealed that various growth parameters of *H. infixaria* except wing expanse, larval and pupal length varied significantly due to feeding on different clones. The average length of loopers fed on TV1, TV9, TV25 and Teen ali 17 were 44.86 mm, 44.71 mm, 46.78 mm and 45.75 mm, respectively. However, the larvae fed on TV25 were the heaviest (473.33 mg) and those fed on TV9 were the lightest (404.29 mg). Significant variations were noticed in prepupal length and weight where maximum length and weight were again recorded on TV25 (19.78 mm and 243.33 mg, respectively) whereas the minimum length of prepupae was recorded on TV9 (18.00 mm) and weight on Teen ali 17 (210 mm) which was on par with TV1 (211.43 mm). Like larval length, pupal length did not show

Table 1 Larval development of *Hyposidra infixaria* on four clonal varieties of tea *Camellia sinensis*

Clone	Duration of different larval instars (d)						Total
	I	II	III	IV	V	VI	
TV1	3.86 ± 0.14 ab (3–4)	2.43 ± 0.20 a (2–3)	2.57 ± 0.20 a (2–3)	2.86 ± 0.14 a (2–3)	4.00 ± 0.38 ab (3–5)	5.67 ± 0.33 a (5–6)	18.14 ± 0.80 a (16–21)
TV9	4.14 ± 0.14 a (4–5)	2.14 ± 0.14 a (2–3)	2.43 ± 0.20 ab (2–3)	2.71 ± 0.29 ab (2–4)	4.43 ± 0.57 a (3–7)	5.33 ± 0.33 ab (5–6)	18.00 ± 0.53 a (16–20)
TV25	3.44 ± 0.18 b (3–4)	2.11 ± 0.11 a (2–3)	2.11 ± 0.11 b (2–3)	2.22 ± 0.15 b (2–3)	3.00 ± 0.24 b (2–4)	4.50 ± 0.22 b (4–5)	15.78 ± 0.55 b (14–18)
Teen ali 17	3.75 ± 0.16 ab (3–4)	2.13 ± 0.13 a (2–3)	2.75 ± 0.16 a (2–3)	2.63 ± 0.18 ab (2–3)	4.63 ± 0.56 a (2–7)	4.50 ± 0.50 b (4–5)	17.00 ± 0.42 ab (15–19)

Figures in parentheses denote ranges. Means ($\pm SE$) followed by the different letters in a column are significantly different ($P < 0.05$) by DMRT. The same for Tables 2–3.

Table 2 Post larval development of *Hyposidra infixaria* on four clonal varieties of tea *Camellia sinensis*

Clone	Prepupal period (d)	Pupal period (d)	Adult longevity (d)
TV1	2.14 ± 0.14 a (2–3)	7.86 ± 0.34 a (7–9)	5.00 ± 0.38 a (4–6)
TV9	2.22 ± 0.15 a (2–3)	7.57 ± 0.30 a (7–9)	5.14 ± 0.26 a (4–6)
TV25	2.11 ± 0.11 a (2–3)	8.11 ± 0.11 a (8–9)	5.22 ± 0.22 a (4–6)
Teen ali 17	2.25 ± 0.16 a (2–3)	8.00 ± 0.27 a (7–9)	5.25 ± 0.25 a (4–6)

varied significantly due to feeding on different varieties of Colocasia. Naseri *et al.* (2009) observed that the larval and total developmental period of *Helicoverpa armigera* varied due to feeding on different varieties of soybean. Nair *et al.* (2008) documented that the larval developmental period of *H. infixaria* on different hosts including tea varied widely where total larval period was longest on citrus (33.11 d) and shortest on tea (23.97 d). However, the total larval period of the insect on different clonal varieties of tea under present study was shorter compared to the observation of Nair *et al.* (2008). This variation might be due to the differences in rearing conditions and clonal variety of tea used for the study.

Variations in larval, pupal size and weight of *Hyposidra infixaria* due to feeding on different clonal varieties of tea were further supported by earlier workers on different insects. Pansaree *et al.* (2006) found that in *Spodoptera litura*, size of full grown larvae and pupae was maximum on KCA-1 genotype of Colocasia and minimum on Panch Mukhi. Similarly, Naseri *et al.* (2010) found significant differences in the pupal weights of *H. armigera* among 13 soybean varieties they tested but no significant effects were found for the larval host plants (soybean varieties) on the adult size (forewing area). Such variation occurred due to intra-varietal differences in chemical constituents of host plant as opined by Martin and Pulin (2004). However, Barrigossi *et al.* (2002) did not find any significant difference in the consumption rate of cassava hornworm, *Erinnyis ello* L. larvae due to feeding on different varieties of Cassava namely Urubu, Aipim Bravo, Jaburu, and Fio de Ouro.

Variations in the larval instar numbers were also observed in the present study where larvae of *Hyposidra infixaria* had two different instar types, those being the five- or six-instar. The incidence of the six-instar type fed on TV25 was higher than those fed on other three clones. Similar kind of variation in the frequency and number of larval instars due to feeding on different larval diets was reported in *H. armigera* by Casimero *et al.* (2000) and in *Hyphantria cunea* by Gomi *et al.* (2005). According to them, this variation might be due to differences in the nutritive value of the larval diets.

The results of the present study suggested that TV25 was the most suitable clonal variety of tea among the four tea clones tested as it rendered maximum growth and highest survival of the insect. The larvae of *Hyposidra infixaria* took shortest time to develop on TV25 than other three clones. Likewise,

larval, prepupal and pupal weights were significantly more on this clone compare to other three clones. Therefore, looper infested tea gardens of north east India having this clonal variety should take cautious measures like close monitoring and early detection of infestation for effective management of this pest. However, gardens having other three clonal varieties in addition to TV25 viz. TV1, TV9 and Teen ali 17 should also keep vigil to avoid any loss in crop due to looper attack. In future, incorporation of more clonal varieties, seed and other planting materials of tea in such kind of studies will enlighten the planters to identify the preferred host of this pest and thereby help in deciding proper management strategies.

ACKNOWLEDGEMENTS The authors are thankful to Dr. Pradip Ghosh, Ex. Chief Advisory Officer (West Bengal), North Bengal Regional R&D Centre, Tea Research Association, Nagrakata for his support and interest in the work on looper pests of tea.

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黄钩尺蛾在四个茶树无性系品种上的生长和存活

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摘要: 在实验室条件下, 对食叶害虫黄钩尺蛾 *Hyposidra infixaria* Walker 在 4 个茶树 *Camellia sinensis* 无性系品种 (TV1, TV9, TV25 和 Teen ali 17) 上的生长和存活进行了研究, 以确定其最适合寄生的茶树无性系品种。结果表明: 在 TV25 上的黄钩尺蛾幼虫期 (15.78 d) 比在 TV1 (18.14 d), TV9 (18.00 d) 和 Teen ali 17 (17.00 d) 上显著缩短。黄钩尺蛾按幼期龄数分为 5 龄型和 6 龄型两类。6 龄型幼虫在 TV25 上的发生率显著高于其在其他 3 个无性系品种上的发生率。在 TV25 上黄钩尺蛾幼虫和蛹的体重也显著高于在其他 3 个无性系品种上的。同样地, 以 TV25 为食的黄钩尺蛾未成熟阶段的存活率显著高于其以其他 3 个无性系品种为食的存活率。基于生长参数和存活率, 我们发现 TV25 是黄钩尺蛾最适合寄生的茶树无性系品种。

关键词: 黄钩尺蛾; 茶尺蠖; 生长; 存活; 茶树

中图分类号: Q965 **文献标识码:** A **文章编号:** 0454-6296(2011)07-0815-05

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